

What is claimed is:

Patent Claims

The method

1. Method of examining security documents by utilizing capacitive coupling between transmitter and receiver and transmission of energy between transmitter and receiver by bridging an electromagnetic field by electrically conductive security strips, tapes, threads or two-dimensionally structured security materials as well as following evaluation electronics, **characterized by the fact** that several antennae arranged in one or more planes and functioning as transmission and receiving sensors form test fields in the range of conventional optical sensors present in processing machines and spatially corresponding with a capacitive test sensor circuit in a processing machine and activating the test sensor circuit, and that in connecting the antennae electromagnetic energy is transmitted over the test object in dependence of its geometry and/or its conductivity, and that several antennae are energized at least in different phase positions and feed the transmitted energy to a succeeding selective amplifier (14), that for preventing interfering energies as well as for suppressing basic conductivities of test objects, e.g. bank notes, a phase comparator at the output of the selective amplifier as well as special filters for suppressing interfering and extraneous energies and an evaluation unit are arranged such that it is possible to classify electrically conductive security strips, tapes, threads or two-dimensionally structured security materials, whereby the test object is force-guidedly moved through the test field in an undefined lateral disposition during a checking operation.
25. 2. Method according to claim 1, **characterized by the fact** that the electronic evaluation circuitry substantially consisting of an analog to digital converter and controller or integrator (15), trigger (16), controller, mono-flop (17) and/or AND gate (18) defines amplitude limit excesses (A) and/or the

currency-specific time  $t_k$  on the basis of the signal characteristic at the output of the selective amplifier (14).

3. ~~The method~~ Method according to claim 1 or 2, characterized by the fact that an authenticity classification is performed by an electronic evaluation circuitry by setting an amplitude limit (A) for the authenticity of currencies to be checked.

4. ~~The method~~ Method according to claim 4 or 2, characterized by the fact that the classification of different bank notes and/or security documents is performed by an electronic evaluation circuitry by setting, preferably by a controller, a currency-specific time ( $t_k$ ) and that the test objects having a time  $t_1..t_{k-1}, t_{k+1}..t_n$  are sorted out.

5. ~~The method~~ Method according to claim 4, characterized by the fact that with currencies having identical times ( $t_k$ ) an additional examination is performed following the authenticity

6. ~~The method~~ Method according to claim 1 or 2, characterized by the fact that the evaluation electronics, preferably one or more controllers, by time comparison and/or voltage comparison delivers a machine-specific signal for depositing individually classified objects in special slots or stacking containers.

7. ~~The method~~ Method according to claim 1 or 2, characterized by the fact that in a direction intersecting the direction of movement of the test objects the antennae and/or electrodes are of such two-dimensional longitudinal extent that even at a defined lateral play of the test objects and regardless of whether a test object passes through the test apparatus with its front or rear surface facing upwardly, the security strip or thread will in any case sweep over the antennae and/or electrodes contacting them at a defined spacing.

25 8. ~~The method~~ Method according to claim 4 or 2, characterized by the fact that an

additional examination is performed the result of which is combined by an AND gate with the signal of the evaluation electronics without necessitating changing the software of the given processing machine.

*The apparatus*

9. ~~Apparatus~~ for examining security documents having elements for capacitive coupling, transmission of energy between transmitter and receiver by bridging an electromagnetic field by electrically conductive security strips, tapes, threads or two-dimensionally structured security materials and evaluation electronics, for practicing the method according to claim 1, **characterized by**

10 - conventional optical sensors present in a processing machine for activating a capacitive test sensor arrangement;  
- test fields formed by several sensors arranged in one or more planes and functioning as transmitting and receiving antennae;  
- a selective amplifier (14) and

15 - a phase comparator connected to the output thereof;  
- special filters for suppressing interfering and extraneous energies; as well as  
- an electronic evaluation circuit essentially comprising an analog to digital converter and a controller or integrator (15), trigger (16), controller, mono-flop (17) and, if desired, an AND-gate, and that during the checking operation the test object is arranged for moving by the sensors in defined contact therewith at an undefined lateral disposition by means of hold-down devices and/or feed belts (10), rollers arranged in this area.

*The apparatus*

10. ~~Apparatus~~ according to claim 9, **characterized by the fact** that the sensors functioning as transmitting or receiving antennae are structured as strip sensors (8;9) in one plane or in two planes positioned opposite each other and/or mirror-symmetrically.

*The apparatus*

11. ~~Apparatus~~ according to claim 9 or 10, **characterized by the fact** that

the strip sensors (8;9) are provided with recesses and/or apertures and/or windows (7) or that such are arranged in the immediate vicinity of the strip sensors (8;9).

*The apparatus*

12. Apparatus according to one or more of preceding claims 9 to 11,

5 **characterized by the fact** that sensors in test units are arranged mirror-symmetrically relative to the test zones and/or security strips, threads and/or tapes of objects to be checked, preferably bank notes, security documents and packing materials.

*The apparatus*

13. Apparatus for examining security documents having elements for

10 capacitive coupling, transmission of energy between transmitter and receiver by bridging an electromagnetic field by electrically conductive security strips, tapes, threads or two-dimensionally structured security materials and evaluation electronics, for practicing the method according to claim 1, **characterized by the fact** that a plurality of transmitting antennae (A2, A3,

15 B2.1..B2.n) and a plurality of receiving antennae (A1, B1.1..B1.n) forming a test sensor arrangement (54) are arranged such that security strips which are uninterrupted electrically conductive as well as those provided with a plurality of electrically conductive sections insulated from each other in a security strip may be checked, whereby the test sensor arrangement (54) is

20 arranged displaced tangentially parallel to an arcuate conductor (56) or tangentially parallel relative to a feed roller (55) and that there are arranged, orthogonally relative to the direction of the longest dimension of a security strip and orthogonally to the direction of movement of a document to be checked, two transmitting antennae (A2, A3) energized at opposite phases

25 with low or high frequency energy, and one or more oppositely placed receiving antennae (A1) and, between them, several transmitting antennae (B2.1..B2.n) disposed parallel relative to the transmitting antennae (A2, A3) and several receiving antennae (B1.1..B1.n) parallel relative to the transmitting antennae (B2.1..B2.n), whereby adjacent transmitting antennae

B2.I..B2.I+1) and associated receiving antennae (B1.I, B1.I+1) are displaced by a defined distance, preferably the distance between a transmitting antenna (B2.I) and associated receiving antennae (B1.I) and that the shortest distance of a transmitting antenna (B2.I) from its associated Receiving antenna (B1.I)

5 is less than the shortest distance between one of the transmitting antennae (A2, A3) and the receiving antennae (A1).

*The apparatus*

14. ~~Apparatus according to claim 13, characterized by the fact that several transmitting antennae (A2, A3, B2.1..B2.n) and several Receiving antennae (A1, B1.1..B1.n) are arranged over the entire width of the document feed path.~~

*The apparatus*

15. ~~Apparatus according to claim 13 or 14, characterized by the fact that the transmitting antennae (A2, A3, B2.1..B2.n) and the receiving antennae (A1, B1.1..B1.n) are arranged in a plane adjacent to each other, in parallel and displaced such that an authenticity check of the documents is performed independently of sides and independently of edges relative to two parallel document edges.~~

*The apparatus*

16. ~~Apparatus according to claim 13, characterized by the fact that receiving antennae (B1.1..B1.n) and transmitting antenna (B2.1..B2.n) displaced parallel and/or in a line transversely of the direction of are arranged in spaced apart relationship such that each security element to be checked sweeps over a receiving antenna (B1.1..B1.n) and an associated transmitting antenna (B2.1..B2.n) regardless of its disposition within the document.~~

*The apparatus*

17. ~~Apparatus according to claim 13, characterized by the fact that the longest side of a transmitting antenna (B2.I) and the longest side of the associated receiving antenna (B1.I) corresponds to the width of the conductive marking of the security strip.~~

*The apparatus*

a 18. , Apparatus according to claim 13, characterized by the fact that following rectifiers (45, 48..50) and selective amplifiers (46, 51..53) there are arranged manipulatable or software-controlled switching and setting elements, in particular micro-controllers (47) such that the output signals of the selective amplifiers (46, 51..53) may be combined or logically connected.

*The apparatus*

a 19. , Apparatus according to claim 13, characterized by the fact that following rectifiers (45, 48..50) and selective amplifiers (46, 51..53) there are arranged manipulatable or software-controlled switching and setting elements, in particular micro-controller (47) such that a change-over between different types and kinds of documents and degrees of wear is performed without a change in the arrangement of the sensors.

*The apparatus*

a 20. , Apparatus according to claim 13, characterized by the fact that the shortest distance between two transmitting antennae (B2.I) arranged in a row is greater than the shortest distance between two electrically conductive and insulated markings of the security strip and that change-over elements are arranged such that the antennae (A3) are used either as transmitting or as receiving antennae, depending upon the feeding of the document to be checked.

*The apparatus*

a 21. , Apparatus according to claim 13, characterized by the fact that software or manually controlled switching elements are arranged such that one or more transmitting antennae (B2.I) and the corresponding receiving antennae (B1.I) may be selectively activated or deactivated.

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